

ENGINEERING STATEMENT
PREPARED ON BEHALF OF
MSTV
FOR JOINT COMMENTS
AND INFORMAL OBJECTION TO THE
PETITION FOR DECLARATORY RULING
BY QUALCOMM INCORPORATED
RE USE OF OET BULLETIN 69
METHODOLOGY UNDER SECTION 27.60
OF THE FCC RULES

MARCH 2005

COHEN, DIPPELL AND EVERIST, P.C.
CONSULTING ENGINEERS
RADIO AND TELEVISION
WASHINGTON, D.C.

COHEN, DIPPELL AND EVERIST, P. C.

City of Washington)
) ss
District of Columbia)

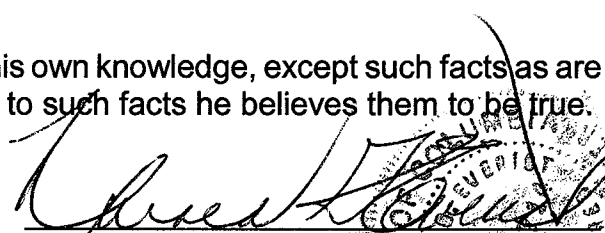
Donald G. Everist, being duly sworn upon his oath, deposes and states that:

He is a graduate electrical engineer, a Registered Professional Engineer in the District of Columbia, and is President, Secretary and Treasurer of Cohen, Dippell and Everist, P.C., Consulting Engineers, Radio - Television, with offices at 1300 L Street, N.W., Suite 1100, Washington, D.C. 20005;

That his qualifications are a matter of record in the Federal Communications Commission;

That the attached engineering report was prepared by him or under his supervision and direction and

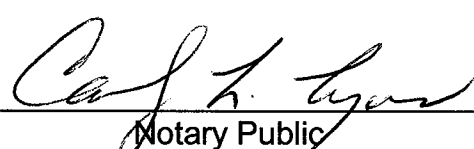
That the facts stated herein are true of his own knowledge, except such facts as are stated to be on information and belief, and as to such facts he believes them to be true.



Donald G. Everist
District of Columbia
Professional Engineer
Registration No. 5714

Subscribed and sworn to before me this 9th day of March, 2005.





Notary Public

My Commission Expires: 2/22/2008

COHEN, DIPPELL AND EVERIST, P. C.


City of Washington)
) ss
District of Columbia)

Ross J. Heide, being duly sworn upon his oath, deposes and states that:

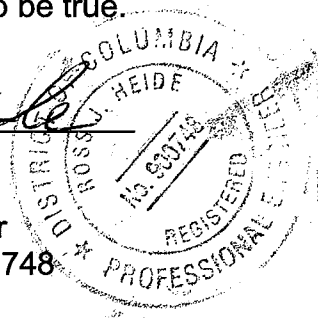
He is a graduate of the Massachusetts Institute of Technology in Operations Research and Management Science, a Registered Professional Engineer in the District of Columbia, and employed by Cohen, Dippell and Everist, P.C., Consulting Engineers, Radio - Television, with offices at 1300 L Street, N.W., Suite 1100, Washington, D.C. 20005;

That the attached engineering report was prepared by him or under his supervision and direction and

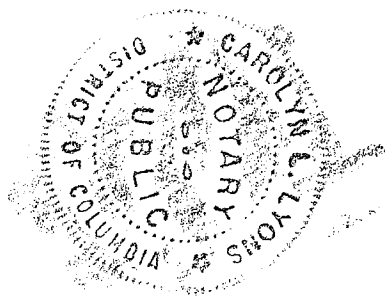
That the facts stated herein are true of his own knowledge, except such facts as are stated to be on information and belief, and as to such facts he believes them to be true.



Ross J. Heide
District of Columbia
Professional Engineer
Registration No. PE900748



Subscribed and sworn to before me this 9th day of March, 2005.





Notary Public

My Commission Expires: 2/28/2008

I. INTRODUCTION

This engineering statement has been prepared on behalf of the Association for Maximum Service Television (“MSTV”) and the National Association of Broadcasters (“NAB”) as part of their Joint Comments (and Informal Objection) to the Petition for Declaratory Ruling filed with the Federal Communications Commission (“FCC”) by Qualcomm Incorporated (“Qualcomm”). By its Petition, Qualcomm seeks to change the method of determining protection of incumbent broadcasters under Section 27.60 of the FCC’s Rules.

There are two simple and compelling engineering reasons why the Petition must be denied. First, the proposed changes to Section 27.60 methodology are so profound that they cannot possibly be considered as a “clarification” of the existing Rules. Therefore, the proposed changes cannot be the subject of a declaratory ruling. Second, the proposed modified OET Bulletin 69 (“OET-69”) methodology and de minimis allowance are not appropriate for the protection criteria specified in Section 27.60 of the FCC Rules. This engineering statement provides the technical foundation for these two basic reasons. The following discussion consists of two main sections:

- Qualcomm’s engineering attachments and lack of justification
- Specific flaws and inapplicability of the proposed modified OET-69 method

II. ENGINEERING ATTACHMENTS AND QUALCOMM’S JUSTIFICATION

Attachment A to the Qualcomm Petition is the “Declaration of William Meintel” from TechWare, Inc. (“TechWare Declaration”). The TechWare Declaration does not provide a single justification or claim of merit for the use of OET-69 as an alternative to Section 27.60. The Declaration simply states that the listed software changes could be made to incorporate Wireless Communication Service (“WCS”) transmission into the OET-69 methodology but did not address the appropriateness of the OET-69 methodology. We do not dispute the TechWare Declaration and

are willing to concede the obvious: software can easily be modified to do the wrong thing, and thereby, give an incorrect result.

Attachment B to Qualcomm's Petition is the engineering exhibit authored by Louis R. duTreil, Jr. and David E. Dickmann of Professional Communications Consultants, Inc. ("PCCI Exhibit"). The PCCI Exhibit does not provide any technical justification for the use of OET-69 under Section 27.60 of the FCC Rules. The Exhibit is compromised mainly of three hypothetical examples that serve only to demonstrate that it is possible to generate maps and tables with the proposed method.

While the proposed method does incorporate the channel/service relationships and D/U ratios specified in Section 27.60 of the FCC Rules, these changes basically serve to avoid direct contradiction of the promulgated rules. Elimination of a potential contradiction does not constitute justification.

The exhibit also attempts to address the issue of combining multiple undesired signals within a television station's protected contour. Here, the exhibit's only explanation is egregiously wrong and repeatedly misrepresents the term "worst-case" interference. This false rationale is described in detail under the heading below "RSS Combination of Undesired Signals Is Not "Worst-Case".

Absent any legitimate technical justification for its proposal, Qualcomm, therefore, relies on supposed economic and "public interest" benefits. These issues are addressed in the main pleading. One point however is worth including here before discussion of specific technical problems with the proposal. Even where a 2% de minimis allowance and the OET-69 methodology is permitted (or mandated) in Parts 73 and 74, these methods are codified in those Rules. Attempting to insert these changes into the Part 27 Rules by means of a declaratory ruling is an abuse of the process.

III. FLAWS AND INAPPLICABILITY OF QUALCOMM'S PROPOSED METHOD

Qualcomm seeks to portray the use of their modified OET-69 simply as an alternative calculation method for the broadcast protection specified in Section 27.60 of the FCC Rules. In fact, the Qualcomm proposal seeks to significantly reduce the full protection of incumbent broadcasters (both authorized and proposed) that is the foundation of the promulgated rules.^{1, 2, 3} OET-69 is not just an alternative method of predicting a signal field strength (both desired and undesired) at a given point. OET-69 includes a host of features and flaws that would distort the intended method of Section 27.60(b)(1)(iii) beyond all recognition.

This section explains why the following problems with Qualcomm's proposal render it inapplicable as a method of "justifying the proposed separations" under Section 27.60:

- OET-69 not designed for Qualcomm's proposed use
- Section 27.60 D/U ratios apply only at the broadcast service area periphery
- Allowance of 2% new interference under FCC processing guidelines is now 0.1% for DTV full service, but should be zero for the subscription services envisioned by Qualcomm
- Section 27.60 D/U ratios not intended to be reduced by receive antenna directivity
- Ignores service outside the arbitrary Grade B or noise-limited contour
- Cumulative contribution of all undesired signals is ignored
- Root-sum-square combination for the undesired MediaFlo signals is misrepresented
- "Good enough" for Part 74 is not a justification

¹"In the Matter of Reallocation and Service Rules for the 698-746 MHz Spectrum Band (TV Ch.52-59)", GN Docket No. 01-74, NPRM, FCC 01-91, 3/28/01, ¶29.

²"In the Matter of Reallocation and Service Rules for the 698-746 MHz Spectrum Band (TV Ch.52-59)", GN Docket No. 01-74, Report and Order, FCC 01-364, 1/18/02, ¶52.

³"Second Periodic Review of the Commission's Rules and Policies Affecting the Conversion to Digital Television", MB Docket No. 03-15, FCC 04-192, 9/7/04, ¶117.

OET-69 Not Designed for Qualcomm's Proposed Use

The analysis submitted by Qualcomm in support of its petition for declaratory ruling is based on an inappropriate calculation that drastically understates the amount of interference its short-spaced operations will cause. Qualcomm seeks to modify OET-69 to justify intrusion into a television station's Grade B or noise-limited service area. OET-69, which relies heavily on the research MSTV and the Broadcasters Caucus provided to the Commission, was never intended to evaluate new non-television services or justify the short-spacing of such services. Rather, OET-69 was designed to predict interference resulting from the introduction of digital television service into the existing analog environment. The OET-69 model was designed to evaluate television service and coverage in accordance with Sections 73.622, 73.623 and 74.704 of the FCC's rules which relate to the assignment of digital television service *within the existing analog television service environment*.⁴

OET-69 was developed against the background knowledge that the universe of analog stations was closed and the existing population of analog stations was by and large in compliance with the minimum spacing requirements. These assumptions were used to reduce the model's complexity and improve its computational speed. OET-69 intentionally selected parameters (D/U ratios) that are only applicable to computing interference at the outer edge of the TV station's service area, where weak signal conditions generally exist. It does not include D/U ratios to predict interference that may affect a TV station's core service area where strong signal conditions predominate.⁵ Since the DTV allotment table was based primarily on geographic spacing, the need to accurately predict such close-in interference was eliminated from the OET-69 model. In short,

⁴“In the Matter of Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service”, MM Docket No. 87-268, 5th Report and Order, FCC 97-116, 4/12/97 and 6th Report and Order, FCC 97-115, 4/21/97.

⁵The OET-69 software used by the FCC includes place holders in the code for different D/U ratios to be used in moderate and strong signal conditions. However, these higher D/U ratios have not been implemented for the reasons cited.

OET-69 was not designed to compute interference under strong signal conditions and lacks the appropriate parameters (D/U ratios) to correctly predict interference from collocated or nearby interferers. Modifying OET-69 to use Section 27.60 D/U ratios, which are also based on weak signal conditions at the service area periphery, will lead to erroneous and meaningless results.

Part 27 D/U Ratios Designed for Boundary Only

It is clear throughout the Part 27 rulemaking process⁶ that the D/U ratios codified in Section 27.60 were designed to be applied only at the boundary of the broadcasters protected contour. Examination of the relevant record was unable to uncover a single reference to the concepts of co-siting, co-location or maintaining D/U ratios at points within the protected contour. The record consistently speaks in terms of separations and distances from (as in “outside”) the protected contour. This absence from the discourse of even a nod to interior siting is in stark contrast with the record in developing the protection rules for digital LPTV which specifically addressed the issues of locating an undesired adjacent channel within a protected contour.⁷

The restriction of the D/U ratios to application at the protected service area periphery was made for sound technical reason. Due to dynamic range limitations on receiver performance characteristics for both NTSC and DTV, the margin by which the desired signal must exceed the undesired signal at the threshold of viewability is much higher at strong desired signal levels. As counterintuitive as it seems, this means that the D/U ratios for adjacent channels must be higher inside a protected station’s service area where the desired signals are stronger than at the boundary where the desired signals are weakest. This fact is recognized by ATSC in its recommended

⁶“In the Matter of Reallocation and Service Rules for the 698-746 MHz Spectrum Band (Television Channels 52-69)”, GN Docket No. 01-74, Report and Order, FCC 01-364, 1/18/02 and Memorandum Opinion and Order, FCC 02-185, 6/14/02.

⁷“In the Matter of Amendment of Parts 73 and 74 of the Commission’s Rules to Establish Rules for Digital Low Power Television, Television Translator and Television Booster Stations and to Amend Rules for Digital Class A Television Stations”, MB Docket No. 03-185, FCC 04-220, 9/30/04, ¶s 108 thru 111.

receiver performance guidelines⁸ where the D/U threshold for strong desired signal conditions is 13 dB to 14 dB higher than the D/U threshold for weak and moderate signals.

When OET-69 was being established as the method for evaluating broadcast-to-broadcast interference, the lab results did not include signal adjacent channel interference under strong signal conditions because of test bed limitations.⁹ However, this was not viewed as a significant problem because of the intended use of OET-69 for predicting boundary interference under weak to moderate signal conditions.

However, subsequent studies have consistently demonstrated that the performance characteristics of television receivers, both analog and digital, require greater protection (higher D/U ratios) from adjacent channel interference under strong signal conditions.¹⁰ Other studies that use an analog or narrow band interfering signal show similar results indicating that the relative power of the interfering signal has the more significant effect rather than the spectrum shape of the interfering signal.^{11, 12} In fact, the requirement for higher D/U ratios under strong signal conditions appears to be a universal characteristic of receivers, including PAL television receivers.¹³

⁸“ATSC Recommended Practice: Receiver Performance Guidelines” Doc. A/74, June 18, 2004, Table 4.2, p.13.

⁹“Summary of the Grand Alliance VSB Transmission System Laboratory Tests”, Wayne Bretl and Gary Sgrignoli, Zenith, IEEE Transactions on Consumer Electronics, Vol. 42, No. 3, June 1996.

¹⁰“Evaluation of DTV Taboo Channel Interference into NTSC Under Strong Signal Conditions: Supplemental Report” ATTC, Document #98-01, Oct. 1, 1998. Although this report specifically addresses taboo channels, differences relative to weak signals would be even more pronounced with 1st adjacent signals.

¹¹Analog into DTV: “The Susceptibility of DTV Receivers to NTSC Interference”, ATTC, Document #03-01, January 7, 2003.

¹²Analog (narrow-band) into NTSC: “Receiver Susceptibility Measurements Relating to Interference Between UHF Television and Land Mobile Radio Services”, Daniel J. Stanks, OET TM 87-1, April 1986.

¹³“Adjacent and Co-Channel Interference from Direct Sequence Spread Spectrum Systems on Analog PAL”, D. Dres and P. Constantinou, IEEE Transactions on Broadcasting, Vol. 47, No. 3, September 2001.

De Minimis Allowance

Even if it were appropriate to create a 2% de minimis allowance for paid services (which are secondary to free over-the-air full-service broadcasters during the transition), in the Second Periodic DTV Review the FCC has established a 0.1% de minimis standard for the indefinite future.¹⁴ This 0.1% standard may apply for the duration of the transition. Therefore, establishing a de minimis standard for new interference caused to broadcasters from Part 27 services during the transition that is significantly different from zero has no rationale.

Section 27.60 D/U Ratios Not Intended To Be Reduced by Receive Antenna Directivity

The D/U ratios and method that were established through the rule making process stand on their own and were not intended to be further reduced by any hypothetical receive antenna rejection of the undesired signal. The Qualcomm proposal would effectively reduce the promulgated Section 27.60 protection ratios by up to 14 dB through the inappropriate use of a receive antenna factor built into OET-69. This 14 dB reduction would compound the error of D/U ratios that are too low for strong and moderate signal conditions.

OET-69 Ignores Predicted Service Outside the FCC Contour

Another bias inherent in the OET-69 methodology is the exclusion of areas and population with Longley-Rice predicted service outside the FCC contour (Grade B or noise-limited). Admittedly, the more straight-forward method of contour overlap also ignores service that Longley-Rice would predict outside the contour. However, the OET-69 bias occurs because it excludes service lost to terrain effects inside the contour, but does not add terrain-favored reception outside

¹⁴“Second Periodic Review of the Commission’s Rules and Policies Affecting the Conversion to Digital Television”, MB Docket No. 03-15, FCC 04-192, 9/7/04, ¶56.

the contour. This bias provides an additional amount of protection reduction (as opposed to accuracy and fairness) that Qualcomm hopes to achieve.

RSS Combination of Undesired Signals Is Not “Worst-Case”

As described below, OET-69 does not account for the cumulative adverse effect of multiple undesired signals, either on the same frequency or within the relatively broad frequency range of a receiver’s front end. However, because multiple MediaFlo transmitters in a market constitute a single proposal, Qualcomm is forced to account for them. Qualcomm’s rationale for the use of the root-sum-square (“RSS”) method to account for multiple MediaFlo undesired signals is not justified based on engineering principles, and is therefore, misleading. Contrary to Qualcomm’s claim, the RSS method is actually the most optimistic treatment of noise power and is reserved for cases where the signals of the separate noise or noise-like contributors are totally uncorrelated.¹⁵

Qualcomm’s claim that the proposed treatment is “worst-case” because the signals “in fact may cancel in some cases”¹⁶ is very misleading. For there to be any meaningful cancellation of the waveforms, there would by definition also exist substantial reinforcement of the undesired signal. Combining undesired signals using the RSS method would only be justified if Qualcomm actually took steps to ensure that the streaming signals from multiple transmitters were totally uncorrelated. Qualcomm has not provided sufficient technical details to make a determination, but it is not likely that enforced uncorrelation would be the case under all environmental conditions.

¹⁵“Principles of Communications Systems”, 2nd Ed., McGraw-Hill 1986, Herbert Taub & Donald L. Schilling, “Ch. 7.7 Superposition of Noises”, p.325.

¹⁶ Attachment B, p.3, Last ¶, Qualcomm Petition.

Cumulative Contribution of Other Undesired Signals Is Selectively Ignored

An inherent flaw of the OET-69 methodology is that it does not include the cumulative effect of multiple undesired signals. Qualcomm seeks to exploit and compound this flaw by proposing to ignore interference to a broadcaster caused by MediaFlo where there is a sufficiently strong undesired signal other than MediaFlo's. Contrarily, Qualcomm does not propose to count interference where the MediaFlo contribution alone meets the D/U requirement, but would not in combination with existing undesired signals.

Elevation Patterns Probably Inaccurate

Although the issue is (conveniently) not addressed directly by Qualcomm, the portion of Figures 1, 2, and 3 presumably copied from the output of the modified program show that the same "DEFAULT" vertical antenna pattern is used for both the broadcast and MediaFlo antennas. The assumed vertical pattern given in OET-69, Table 8 for UHF DTV stations is typical of a 24-bay antenna with 0.75° electrical beamtilt. Qualcomm has not provided sufficient detail to make a determination, but it is probable that the OET-69 assumed vertical patterns would significantly underestimate the amount of close-in interference compared to the vertical pattern(s) of the antennas that Qualcomm would employ. The proposed use of OET-69 in the LPTV DTV R&O specifically proposed changes to address this issue.¹⁷ The term "actual parameters" in Section 27.60(b)(1)(iii) certainly does not mean everything except the actual vertical pattern.

Part 73 Seven Years Ago Vs. Part 27 Now

One must also reject the argument that OET-69 should be applied as the presumptive method under Section 27.60(b)(1)(iii) despite its flaws simply because they are tolerated for current use

¹⁷"In the Matter of Amendment of Parts 73 and 74 of the Commission's Rules to Establish Rules for Digital Low Power Television, Television Translator and Television Booster Stations and to Amend Rules for Digital Class A Television Stations", MB Docket No. 03-185, FCC 04-220, 9/30/04, ¶104.

under Parts 73 & 74. OET Bulletin No. 69 was released July 2, 1997. Extensive familiarity and experience with the methodology existed within the FCC and industry at the time the Part 27 Rules were proposed (2001) and finalized (2002). Had the OET-69 Methodology been appropriate, it would have been considered and incorporated during the lower 700 MHz rulemaking process.

Moreover, the D/U ratio methodology of OET-69 is overdue for reevaluation using current generation receivers. Lab analysis and testing is likely to dictate modification OET-69's treatment of two important factors. The first and most important factor is the variation of receiver performance, and therefore, variation of the appropriate D/U ratio with the absolute (as opposed to relative) signal strength. The second factor is the receiver desensitization effect of second and even third adjacent channels. Until these issues are resolved, it is ill-conceived to extend the application of OET-69 to new uses.

IV. CONCLUSION

For the detailed reasons outlined above, Qualcomm's petition must be denied because it seeks to fundamentally alter the Part 27 technical basis for calculating protection to incumbent broadcasters that was carefully crafted through the very recent rulemaking process. Even if these proposed changes did not far exceed what could reasonably be considered a clarification of appropriate methodology through a declaratory ruling, the proposed method would not survive a legitimate rulemaking process based on technical merit because it is so biased and technically flawed.